DAG-TM Workshop at Langley Research Center
November 13-15, 2002
Notes by David Wing

CE5 concept decisions / agreements:

- ATSP is not responsible for separation of autonomous aircraft, period.
- Controllers cannot "cancel free flight." Transition from autonomous to managed status is initiated by the pilot and must be accepted by the controller.
- RTA constraint is a clearance (with a void tolerance) to enter controlled airspace. Failure by the autonomous aircraft to meet the constraint (within the tolerance) results in cancellation of the clearance.
- Autonomous aircraft have priority over managed aircraft in a conflict, with one possible exception to be further discussed: autonomous aircraft that are flying in tactical mode.
- Intent information broadcast will be limited by currently projected broadcast data link capabilities. If these capabilities are insufficient, we will determine what capabilities are needed.
- A sub team will determine a comprehensive rule set that governs priority between aircraft.
- The concept includes RVSM. Other similar considerations will be addressed on a case-by-case basis as they come up.
- Minimum equipage for managed aircraft is a Mode C transponder. Ground broadcast (e.g., TIS-B) is available to broadcast radar data for minimally equipped managed aircraft.
    - However, due to development limitations, our simulations for TRL 4 research will assume minimum equipage will include RNAV and broadcast data link (e.g., ADS-B) with state data only.
    - Higher equipage levels for managed aircraft will also be represented in simulations.
- The concept does not rely on air-air voice communication. Simulations will not incorporate it.

CE5 Research Issues

1. Scalability validation
2. Ground protection from autonomous a/c maneuvers
3. Status transition time from autonomous to managed status
4. Challenging mixed equipage conflicts and their resolution
5. Look-ahead horizon air vs. ground
6. System reaction to flow upsetting events
7. Mistaken responsibility b/w air and ground
8. Conflicting constraints
9. Air/ground redundancy for separation
10. Evaluate priority rules for CR of mixed equipage conflicts
11. Do we need a global deconfliction strategy?
12. Wind and weather errors
13. Cooperative or non-cooperative resolution for autonomous conflicts
14. Must all autonomous aircraft use the same CD&R algorithms
15. Must air and ground use the same CD&R algorithms
16. ADS-B failure
17. Gaggle density TFM for CE-5 feasibility
18. Intent issues

Top 7 for experiments:

1, 2, 4, 6, 10, 15, 17

Top 6 for informed decisions:

10, 11, 13, 14, 15, 18

CE5 Environmental Conditions that Excite Feasibility and Benefits

- Traffic density
  - Same number of airplanes (bank) in less time
  - More aircraft in a given airspace
- Terminal arrival transition regions
  - Trajectories complex, 3D, constrained, crossing overflights, potentially departures
- Static or dynamic restrictive airspace
  - SUA
  - Weather
- Dynamic change to arrival flow constraints
  - Dynamic loss of arrival capacity (airport acceptance rate)
  - Change of arrival gate
  - Change of RTA slot (e.g., AOC request)
- Mixture of aircraft types w/ differing performance
- Realistic baseline wind condition (actual and forecast)

Experiment Schedule

- Site connectivity (June 2003)
  - Completion milestone for verification of lab functionality to support DAG-TM research
  - Work starts immediately to connect the labs
- Development activity (September 2003)
  - Most rapid prototyping is complete
  - Dry run of capabilities needed to support following experiment
  - Possible demo to management / external
- A/G Experiment (Early 2004)
  - Design / feasibility
- A/G Experiment (Late 2004)
  - Feasibility / benefits

Experiment Planning Decisions (pending review and thought)

- CE6 will be removed from FY04 joint simulations.
- We will plan a week for training, but try to reduce it through detailed training planning.
- Each scenario will include both CE5 and CE11.
- "Control" case is that to which we compare the concept.
- Control cases will be included in all a/g experiments.
- The control case will be run at one test condition only, for the sake of economy of time.
- We will try to limit the experiment time to 1 month total. 2 weeks of this would be training and basic test & control cases. May need to insert a week (or more) break between every 2 weeks of running.
- This time limit probably allows max of 2 (or maybe 3) research issues per experiment.
- Estimates of time required assume 6 replications per condition. May consider restricting statistical significance to the pilots only.

Tiger Teams

- CD&R
    - Harmonized approach to be used in the simulations for as minimum requirements for intent, priority rule set, and resulting CD&R
    - Richard B., PK, Walt, Ed, Vern, Tom, Cesar, Karl, David
    - Report back Feb 28
- Experiment Issues Refinement
    - Review and prioritize issues for A/G sims
        - Reduce issues for A/G sim experiments
        - Recommend how to address remainder (informed decision)
    - David, Karthik, Vern, Nancy, Paul, Steve
    - Report back Jan 30 or earlier
- Experiment Design
    - Consecutive to Experiment Issues Refinement team
    - High level proposal for design, considering logistical constraints
    - Identify risks, costs, and constraints
    - Incorporate Issues team input
    - PK, David, Karthik, Don, Bryan, Nancy, Paul, Ev, Mike
    - Report back Mar 14
- Technical connectivity
    - Determine how to connect the labs
    - Tom, Mike P., TBD (CDTI)
    - Report back Dec 31
- Simulation requirements
    - Mark, CTO4
    - Report back Feb 28

For all leaders of tiger teams, provide ½ page mission statement:

- Membership list
- Mission statement
- Target report-back date(s)
- Team output
- Due November 27, 2002.